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Effect of Charge Carrier Density on the Vortex Regimes in $\mathbf{Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}}$ Single Crystals[1] P. GYAWALI, V. SANDU, C.C. ALMASAN, Kent State University, B.J. TAYLOR, M.B. MAPLE, University of California at Diego — We report the evolution of the vortex matter state in the temperature and field range where the second magnetization peak SMP is present by studying the magnetization and magnetic relaxation of a series of $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ ($x = 0.13$, $T_c = 82$ K; $x = 0.34$, $T_c = 50$ K; $x = 0.47$, $T_c = 34$ K) single crystals. Our study has shown that the main ingredient that controls the evolution of the vortex matter through the different regimes is the charge carrier density. The SMP is first enhanced and then suppressed as Pr concentration increases. The reason for this behavior is the softening of the elastic moduli, which makes the vortex lattice less stable to defect invasion. Within the collective creep theory, we determined the apparent activation energy. Its evolution with current density has shown that the vortex system is predominantly elastically pinned below the SMP, while above there is a smooth crossover to a vortex regime most likely dominated by the proliferation of dislocations.

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